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Mode-coupling approximation in a fractional-power generalization: Particle dynamics in supercooled liquids and glasses

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Abstract

We describe the particle dynamics in supercooled liquids in the mode-coupling approximation in a fractional-power generalization, where the kinetic integro-differential equations are exactly derived from the equations of motion of the dynamical variables by projection operator methods. We show that in the case of separated time scales in the particle dynamics and with the nonlinear interaction between the stochastic and translation motion modes taken into account, the solution of the equations gives a well-defined picture of singularities of the one-particle dynamics of supercooled liquids and glasses. Comparison with the data for the metal alloy Fe 50Cr 50 atomic dynamics simulation demonstrates a good agreement in the entire temperature range corresponding to the supercooled liquid and glass phases. © 2012 Pleiades Publishing, Ltd.

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Keywords

disordered system, integro-differential equation, mode-coupling approximation, nonergodicity, projection operator, space-time correlation, vitrification